3.1 Introduction to the Central Plateau

J.P. McDonald

When the Hanford Site was operating, spent fuel reprocessing, isotope recovery operations, and associated waste management activities occurred within the 200 East and 200 West Areas located in the central portion of the Site. This region is defined as the Central Plateau and is divided into Inner and Outer Areas (Figure 3.1-1). As stated in *Central Plateau Cleanup Completion Strategy* (DOE/RL-2009-81), the Inner Area is the "final footprint area of the Hanford Site that will be dedicated to waste management and containment of residual contamination," while the Outer Area is the remainder of the Central Plateau.

Spent fuel reprocessing, isotope recovery operations, and associated waste management activities occurred within the Central Plateau.

Four groundwater operable units are associated with the Central Plateau. These operable units encompass groundwater contamination from the 200 East and 200 West Areas, and regions in which this contamination migrated beyond the Central Plateau. As explained in Chapter 1.0, groundwater operable units are associated with informally defined groundwater interest areas that cover the entire Hanford Site. This chapter addresses monitoring results for the groundwater interest areas associated with the Central Plateau groundwater operable units: 200-BP-5, 200-PO-1, 200-UP-1, and 200-ZP-1 (Figure 3.1-1). This section provides background information regarding the Central Plateau.

Central Plateau at a Glance

Consists of the 200 West Area, 200 East Area, and nearby surrounding regions. Divided into Inner and Outer Areas for the purpose of cleanup activities.	
200 West Area	**200 East Area**
Two groundwater operable units: 200-UP-1 and 200-ZP-1	Two groundwater operable units: 200-BP-5 and 200-PO-1
Contains four deactivated plants formerly used for plutonium separation (T Plant and REDOX), plutonium finishing (Plutonium Finishing Plant), and uranium recovery operations (U Plant)	Contains two deactivated plants (B Plant and PUREX) formerly used for plutonium separation and recovery of specific isotopes
Contains many inactive waste sites, four active disposal sites (SY Tank Farm, State-Approved Land Disposal Site, Environmental Restoration Disposal Facility, and Mixed Waste Trenches), and seven RCRA sites	Contains many inactive waste sites, several active disposal sites (Treated Effluent Disposal Facility and AN, AP, AW, AY, and AZ Tank Farms), and 12 RCRA sites
Interim groundwater remediation active in 200-ZP-1 and formerly active in 200-UP-1; final pump-and-treat remedy for 200-ZP-1 planned to begin in 2012; pump-and-treat system at S-SX Tank Farms planned for 2012; soil vapor extraction being performed at Plutonium Finishing Plant	A treatability test is being performed on a uranium-containing perched water zone beneath the B Complex
Final ROD in place for 200-ZP-1; draft RI/FS released for 200-UP-1	RI/FS initiated for 200-BP-5; draft RI released for 200-PO-1

The following groundwater contaminants occur in substantial plumes within the Central Plateau groundwater operable units:

- Carbon tetrachloride is widespread in the 200 West Area at concentrations up to 780 times the 5 µg/L drinking water standard.
- Nitrate concentrations exceed the 45 mg/L drinking water standard in numerous wells within all four operable units, but the 200 West Area plumes are the largest in areal extent.
- Tritium concentrations exceed the 20,000 pCi/L drinking water standard in all four operable units. The plumes largest in areal extent occur within 200-UP-1 and 200-PO-1.
- Iodine-129 concentrations exceed the 1 pCi/L drinking water standard in all four operable units. The plume largest in areal extent occurs within 200-PO-1.
- Technetium-99 occurs above the 900 pCi/L drinking water standard in all four operable units, although it is mostly associated with tank farm and uranium recovery waste sites.
- Concentrations of total chromium occur above the 100 µg/L drinking water standard in the 200 West Area operable units. The plume in 200-UP-1 is the largest in areal extent.
- Uranium concentrations exceed the 30 µg/L drinking water standard in all but 200-ZP-1. The highest concentrations occur in 200-BP-5.

3.1.1 Hydrogeology

Important elements of the Central Plateau hydrogeology are the distribution and properties of the geologic units, structural features, and the presence of mud units and basalt bedrock above the water table. A stratigraphic column for the Hanford Site is shown in Figure 3.1-2. The stratigraphic units present beneath the Central Plateau consist of (in ascending sequence) (1) bedrock of the Saddle Mountains Basalt, (2) semiconsolidated sand and gravel of the Ringold Formation unit A, (3) silt and clay of the Ringold lower mud unit, (4) semiconsolidated sand and gravel of the Ringold Formation unit E, (5) the fine- to coarse-grained Cold Creek unit, and (6) unconsolidated sand and gravel of the Hanford formation. Appendix E describes these units in detail.

A hydrostratigraphic cross-section of the Hanford Site, including the 200 West and 200 East Areas, is shown on Figure 3.1-3. The unconfined aquifer occurs mostly within the Hanford formation and Ringold unit E, and the low-permeability Ringold lower mud unit forms the base of the aquifer in most areas. The thickness of the unconfined aquifer varies substantially within the Central Plateau from over 200 meters southeast of the 200 East Area to zero where the aquifer pinches out against mud units and basalt above the water table. Depths from land surface to the water table range from zero adjacent to the Columbia River to 106 meters between the 200 East and 200 West Areas. Confined aquifers occur within unit A between the lower mud unit and basalt and within sedimentary interbeds and interflow zones within the basalt. Deviations from this sequence are described in the following sections. Section 3.1.2 describes groundwater flow within the Central Plateau.

3.1.1.1 200 East Area and Vicinity

Within the 200 East Area, substantial portions of the Cold Creek unit and Ringold Formation unit E, lower mud unit, and unit A were removed by erosion such that the Hanford formation overlies basalt bedrock in some places. Thus, the Hanford formation fills a paleochannel trending from northwest to southeast across the 200 East Area (the high hydraulic conductivity region in Figure 3.1-4) (Section 6.2 of PNNL-19702; Chapter 4.0 of PNNL-12261, *Revised Hydrogeology for the Suprabasalt Aquifer System, 200-East Area and Vicinity, Hanford Site, Washington*). The upper part of the unconfined aquifer largely occurs within the Hanford formation, which consists of open-framework gravels in some places and is highly transmissive.

Sand and gravel of the Hanford formation fills a paleochannel trending from northwest to the southeast across the 200 East Area.

East of the 200 East Area near the 216-B-3 Pond and the Treated Effluent Disposal Facility (TEDF), low-permeability Ringold Formation muds occur above the water table (shown on Figure 3.1-3) and form a barrier to groundwater flow in the unconfined aquifer. The uppermost aquifer in this area is the confined aquifer between the Ringold muds and basalt. East of the TEDF is the north-south trending May Junction Fault. Hydraulic head and water chemistry differences across this fault (Sections 4.2.3 and 4.3.2 in PNNL-12261) indicate it is a barrier to groundwater flow in the confined aquifers. While impermeable units have been juxtaposed against more permeable units along part of the fault, the mud units may also have smeared along the fault zone and sealed it (Figure 3.1-3; Plates 8 and 9 in PNNL-12261).

Anticlinal ridges north of the 200 East Area have resulted in substantial areas of basalt above the water table which form barriers to groundwater flow. The most prominent anticline is Gable Butte/Gable Mountain, which is bisected by a sediment-filled water gap known as Gable Gap. Erosion in this gap extended into the uppermost basalt flows resulting in an area of intercommunication between the unconfined aquifer and the underlying confined aquifer in the uppermost sedimentary interbed, the Rattlesnake Ridge interbed (as well as the next underlying interbed, the Selah interbed) (see Figure E-10 in Appendix E). The paleochannel in the 200 East Area extends north through Gable Gap and then trends toward the west along the north side of Gable Butte to west of the 100-BC Area (Figure 3.1-4).

3.1.1.2 200 West Area and Vicinity

The stratigraphy within the 200 West Area is consistent with the sequence of units described in Section 3.1.1, except that the fluvial and lacustrine silts and clays of the upper Ringold are locally present between unit E and the Cold Creek unit. Both the Cold Creek unit and the upper Ringold are entirely above the water table within the 200 West Area (Figure 3.1-3) and have no effect on flow in the unconfined aquifer, but these units affect the vertical migration of constituents in the vadose zone. Along a portion of the east side of the 200 West Area, the Ringold lower mud unit is absent, and the unconfined aquifer is in direct communication with the underlying aquifer in unit A (Figure 3.2-3 in Section 3.2; Section 4.4.1 of DOE/RL-2006-24, *Remedial Investigation Report for the 200-ZP-1 Groundwater Operable Unit*).

The Ringold Formation lower mud unit is absent, and the unconfined aquifer is in direct communication with the underlying confined aquifer along part of the east side of the 200 West Area.

The sediments beneath the 200 West Area dip toward the southwest away from the Gable Butte/Gable Mountain anticline toward the Cold Creek syncline (the syncline is shown on Figure E-3 in Appendix E). As a result, the elevation of the Ringold lower mud unit (the base of the unconfined aquifer) increases toward the northeast. This unit is extrapolated to occur above the water table in a small region between the 200 West and 200 East Areas and is a barrier to flow in the unconfined aquifer (Section 4.2 of PNNL-13858, *Revised Hydrogeology for the Suprabasalt Aquifer System, 200-West Area and Vicinity, Hanford Site, Washington*).

An east-west trending paleochannel occurs north of the 200 West Area. Here, the Cold Creek unit, Ringold Formation unit E, and the lower mud unit were removed by erosion, and the Hanford formation directly overlies Ringold unit A (Sections 4.1.2.1 and 4.1.2.2 of PNNL-13858). The aquifer in this paleochannel is not as transmissive as the paleochannel in the 200 East Area. Along the southern boundary of this paleochannel, the confined aquifer in Ringold unit A is in direct communication with the unconfined aquifer.

3.1.1.3 Central Hanford Site

While most of the 200-BP-5, 200-ZP-1, and 200-UP-1 Operable Units occur on the Central Plateau, much of the 200-PO-1 Operable Unit occurs within the 600 Area between the 200 East Area and the Columbia River. The stratigraphy in this region is very similar to that described in Section 3.1.1, except that the fluvial and lacustrine silts and clays of the upper Ringold are widespread within the vadose zone between unit E and the Cold Creek unit. The water table within the western and central portions of this region mostly occurs within the Hanford formation. In the eastern portion of the 200-PO-1 Operable Unit, the water table occurs within the sediment of Ringold unit E. The Cold Creek syncline reaches its maximum depth in the central portion of the 200-PO-1 Operable Unit, and the thickness of the unconfined aquifer is over 200 meters in this region.

3.1.2 Groundwater Flow

Figure 3.1-5 shows the March 2011 water table map for the Hanford Site, including the Central Plateau. Groundwater in the unconfined aquifer flows from upland areas in the west and southwest toward the Columbia River to the north and east, which is the regional discharge area. Within the Central Plateau, natural recharge to the unconfined aquifer comes from the Cold Creek Valley, Dry Creek Valley, Rattlesnake Hills, and infiltrating precipitation. Groundwater generally flows from west to east, although some of the flow from the 200 West Area and/or north of the 200 West Area turns north and flows through Gable Gap. Previous effluent discharges at U Pond and other facilities caused a groundwater mound to form beneath the 200 West Area that significantly affected regional flow patterns in the past (for example, see Figures 4 through 10 in PNNL-16069, *Development of Historical Water Table Maps of the 200 West Area of the Hanford Site [1950-1970]*). These discharges largely ceased in the mid-1990s, but a remnant mound remains, which is apparent from the shape of the water table contours passing through the 200 West Area (Figure 3.1-5). Currently, the water table elevation in the 200 West Area is up to 10 meters above the estimated water table elevation prior to the start of Hanford Site operations.[1] Equilibrium conditions will be reestablished in the aquifer after dissipation of the mound caused by artificial recharge. When this occurs, the water table still may be 5 to 7 meters higher than before Site operations as a result of increased irrigation activities west of the Hanford Site. The water table beneath the 200 West Area is perturbed locally by discharges occurring at the State-Approved Land Disposal Site (75 million liters were discharged during 2011), as well as by operation of a groundwater pump-and-treat remediation system at the 200-ZP-1 Operable Unit. The water table is expected to be further altered by the 20 extraction and 16 injection wells of the 200 West Area pump-and-treat system when this system begins operating during 2012.

[1] Based on the March 2011 water-level elevation in well 299-W18-15 (135.5 meters, *North American Vertical Datum of 1988* [NAVD88]) and the pre-Hanford water table elevation at the location of this well estimated from *Selected Water Table Contour Maps and Well Hydrographs for the Hanford Reservation, 1944-1973* (BNWL-B-360) (~125.1 meters NAVD88). The peak historical water-level elevation in the 200 West Area occurred at well 299-W18-15 in 1984 (149.1 meters [NAVD88]).

Groundwater in the unconfined aquifer beneath the Central Plateau flows from upland areas in the west toward the regional discharge area north and east along the Columbia River.

Within the 200 East Area, the northwest to southeast trending paleochannel substantially affects groundwater flow. The water table in this area is very flat (i.e., the magnitude of the hydraulic gradient is estimated to be ~10^{-5} meters per meter or less) because of the high permeability of the Hanford formation sediments filling the paleochannel (Figure 3.1-4). Groundwater flow in this region is affected by the presence of low-permeability sediment (i.e., muds) of the Ringold Formation at the water table east and northeast of the 200 East Area, as well as basalt above the water table. These features generally constitute barriers to groundwater flow, although the unconfined aquifer can occur in the fractured and rubbly basalt flow top where it has not been removed by erosion. The extent of the basalt present above the water table continues to increase slowly because of the declining water table, resulting in an even greater effect on groundwater flow in this area. The water table beneath the 200 East Area is 1.8 meters higher than estimated pre-Hanford Site conditions.[2] This is lower than the 5 to 7 meters estimated for the 200 West Area because the aquifer beneath the 200 East Area is more transmissive, which allowed for more lateral flow and less mound formation. When equilibrium conditions are re-established, the water table in the 200 East Area is expected to return to very near the pre-Hanford Site elevation.

The direction of groundwater flow diverges beneath the 200 East Area; some water flows toward the north through Gable Gap, and some flows toward the southeast. This flow pattern can be temporarily altered by large increases in Columbia River stage.

Water enters the 200 East Area and vicinity from the west and southwest, as well as from beneath the mud units to the east and from the underlying aquifers where the confining units have been removed or thinned by erosion. The direction of groundwater flow diverges beneath the 200 East Area, with some water flowing toward the north through Gable Gap and some flowing southeast through the 200-PO-1 Operable Unit. Water-level measurements indicate that groundwater flow is generally north through Gable Gap, but flow conditions can vary due to seasonal changes in river stage that propagate along the paleochannel (Section 2.1.4 of DOE/RL-2008-66, *Hanford Site Groundwater Monitoring for Fiscal Year 2008*). During March 2011, the hydraulic gradient in Gable Gap was toward the north at 7.1×10^{-5} meters per meter. Later during 2011, high river stage conditions caused a flow reversal in Gable Gap. During September, flow through the gap was toward the south with a gradient magnitude of 9.0×10^{-5} meters per meter. Groundwater flow is toward the southeast within the region between the 200 East Area and the Central Landfill. During 2011, the average water-level elevation at the landfill (121.70 meters, *North American Vertical Datum of 1988* [NAVD88] for March 2011) was 0.14 meter lower than the average elevation in the 200 East Area (121.84 meters [NAVD88] for March 2011), yielding a regional hydraulic gradient magnitude of 1.8×10^{-5} meters per meter (see Figure 3.1-5 for the locations of the 200 East Area and the Central Landfill).

[2] Based on the average water-level elevation measured in 53 wells within the 200 East Area during March 2011, all of which have been corrected for deviations of the boreholes from true vertical (121.84 meters [NAVD88]) and the pre-Hanford water table elevation for the 200 East Area estimated from BNWL-B-360 (~120 meters [NAVD88]).

Although the water table is very flat in the 200 East Area, the accuracy of water-level measurements has been improved, leading to a better understanding of groundwater flow.

The accuracy of water-level measurements within the 200 East Area has been improved in recent years by conducting gyroscope surveys to determine well bore deviations from vertical and by performing highly accurate casing elevation surveys (Section 3.2 in DOE/RL-2011-01). Also, current and historical water-level elevation data in the 200 East Area were adjusted for barometric pressure fluctuations during 2011. The results of this work indicate that the groundwater flow direction in the northwest corner of the 200 East Area (at LLWMA-1) is toward the northwest, but flow can temporarily reverse toward the south during years with higher than normal Columbia River stage (Section 3.2.1 of DOE/RL-2011-01). This condition existed during 2011 when flow was toward the south during late summer and fall (Section 3.4). In the southeast part of the 200 East Area at the Integrated Disposal Facility (IDF) and PUREX Cribs, water-level measurements indicate flow is toward the east-northeast. These results have enabled a better understanding of the location of the groundwater flow divide, which occurs somewhere between LLWMA-1 and the IDF and PUREX Cribs (see Figure 3.4-3 in Section 3.4). Uncertainties in groundwater flow at specific monitored facilities within the 200 East Area are discussed in the subsections of Sections 3.4.13 for 200-BP-5 and 3.5.9 for 200-PO-1.

3.1.3 Contaminant Mobility

The rate and direction of groundwater flow is one factor that affects the size and distribution of contaminant plumes, but relative mobility of constituents in groundwater is also a major factor. An understanding of relative mobility is important for interpreting the groundwater sampling results presented in this chapter. Some constituents are fully dissolved in the groundwater and migrate with the groundwater flow, while others interact with the aquifer sediment to some degree (i.e., “sorb” by either adsorption or precipitation) and migrate at a slower rate than the groundwater flow. The degree of sorption for a particular constituent can be described by the value of its distribution coefficient, which is the ratio of the sorbed phase concentration to the dissolved phase concentration. Constituents that do not sorb at all have distribution coefficient values equal to zero, whereas sorbing constituents have distribution coefficient values greater than zero.

Contaminants in the Central Plateau groundwater exhibit variable mobility. Tritium is highly mobile under all conditions (i.e., has a distribution coefficient equal to 0 mL/g) because it is a hydrogen isotope that occurs as part of the water molecule. The mobility of other constituents depends, in part, on geochemical conditions in the aquifer. The groundwater in the Hanford Site unconfined aquifer is generally oxidizing and has a pH of neutral to slightly basic. Under these conditions, constituents such as technetium-99, chromium, and nitrate do not sorb onto aquifer sediments to any appreciable degree, are highly mobile, and migrate at the same rate as the groundwater flow (i.e., the distribution coefficients are equal to 0 mL/g). Other constituents, such as uranium and iodine-129, are considered moderately mobile (i.e., generally have distribution coefficient values between 0 and 1.0 mL/g). The mobility of uranium is complex and can be quite variable depending on geochemical conditions. Within the Central Plateau groundwater, uranium forms complexes with carbonate and hydroxide ions, which limits its sorption ability and increases its mobility. For a comprehensive discussion of uranium geochemistry, including the factors that affect speciation and mobility, see *A Site-Wide Perspective on Uranium Geochemistry at the Hanford Site* (PNNL-17031).

Organic constituents can also exhibit variable mobility because they interact with organic material in the aquifer. These constituents are considered moderately mobile in the Hanford unconfined aquifer because the amount of organic matter in the aquifer is relatively low (Hanford Site groundwater background values for total organic carbon have a geometric mean of 1.3 mg/L and a 95th percentile of 3.3 mg/L [Table ES-1 in DOE/RL-96-61, *Hanford Site Background: Part 3, Groundwater Background*]). Strontium-90 strongly sorbs to aquifer sediments and is considered only slightly mobile (i.e., has a distribution coefficient value greater than 1.0 mL/g). Other constituents, such as plutonium and cesium, sorb so strongly that they are nearly immobile in the subsurface and have not migrated far enough through the vadose zone to reach groundwater. There is some plutonium and cesium in groundwater within the 200-BP-5 Operable Unit, but they were directly injected into the aquifer through the 216-B-5 Injection Well and have not migrated very far from the source area in over 60 years (see Sections 3.4.8 and 3.4.9).

3.1.4 Waste Disposal and Distribution of Contaminants

Waste disposal within the 200 Areas began with startup of plutonium-separation operations in late 1944 (Chapter 4.0 of WHC-MR-0521, *The Plutonium Production Story at the Hanford Site: Processes and Facility History*). Three separations processes were used at the Hanford Site. The earliest was the bismuth-phosphate process, which was used between 1944 and 1956 at T Plant in the 200 West Area (200-ZP-1), and between 1945 and 1952 at B Plant in the 200 East Area (200-BP-5). The REDOX process was used between 1952 and 1967 at REDOX Plant in the 200 West Area (200-UP-1). Finally, the PUREX process was used from 1956 to 1972, and again from 1983 to 1989 at PUREX Plant in the 200 East Area (200-PO-1). Beginning in 1949, the product from the separations plants was further processed at the Plutonium Finishing Plant (PFP) (200-ZP-1), which operated until 1989. Other chemical processes performed in the 200 Areas included uranium recovery at U Plant (200-UP-1) between 1952 and 1957, using the tributyl phosphate process, and radionuclide recovery by various methods at B Plant (200-BP-5) between 1963 and 1983 (PNL-SA-23121 S, *Hanford Technical Exchange Program: Process Chemistry at Hanford (Genesis of Hanford Wastes)*; DOE/RL-98-28, *200 Areas Remedial Investigation/Feasibility Study Implementation Plan – Environmental Restoration Program*).

Plumes of carbon tetrachloride, iodine-129, nitrate, and tritium formed in groundwater beneath the Central Plateau when pond and crib waste reached the aquifer. Some plumes are dispersing naturally, but others require active remediation.

Each of the chemical processing facilities generated multiple waste streams and used multiple waste sites for waste management and disposal. This has resulted in a complex mixture of soil and groundwater contamination that complicates the process of interpreting specific contaminant sources for specific plumes, but the overall pattern of contaminant distribution can be related to chemical processing plant source areas. In general, radioactive waste of higher activity was stored in underground storage tanks, while other liquid waste streams lower in activity were disposed to ponds and cribs. Groundwater plumes of nitrate, tritium, and iodine-129 in all four operable units, as well as carbon tetrachloride in 200-ZP-1, formed when the pond and crib waste reached the aquifer. These plumes expanded as effluent disposal operations continued. Figures 3.1-6 and 3.1-7 show the tritium and iodine-129 plumes in Hanford Site groundwater during 2011. Both constituents occur in extensive plumes east and southeast of the 200 East Area and east of the southern 200 West Area. These plumes originated primarily from cribs associated with the PUREX Plant in the 200 East Area and the REDOX Plant in the 200 West Area. The plumes in the northern 200 West Area are associated with T Plant waste sites, and the iodine-129 plume migrating north from the 200 East Area has been associated primarily with sources in 200-PO-1. Effluent disposal to the ponds and cribs ceased during the 1990s. The groundwater plumes from these sources are dispersing naturally, although some will require active remediation (for example, the carbon tetrachloride plume). Residual contamination continues to enter the aquifer beneath some source areas. Also, constituents of lower mobility in the vadose zone beneath the ponds and cribs may reach the water table in the future, affecting groundwater quality.

There are seven single-shell tank farm waste management areas within the 200 Areas: A-AX, B-BX-BY, and C within the 200 East Area, and S-SX, T, TX-TY, and U within the 200 West Area. Some of the tanks in these farms have leaked and contaminated the vadose zone, and some of this contamination has migrated downward to the groundwater (PNNL-11810, *Results of Phase I Groundwater Quality Assessment for Single-Shell Tank Waste Management Areas S-SX at the Hanford Site*). Migration through the vadose zone may have been facilitated in the past by additions of water from various sources, most notably nearby wastewater ditches and cribs, water supply pipeline leaks, and rainfall/snowmelt runoff events (Sections 3.3.1, 5.1.1, and 5.1.3 of RPP-35485, *Field Investigation Report for Waste Management Area U*). Plumes of nitrate, technetium-99, and chromium from many of the tank farms, as well as uranium from the B-BX-BY Tank Farm, are currently found in the groundwater. These plumes are generally growing in areal extent and exhibit increasing constituent concentrations. This issue is being addressed by pump-and-treat systems where needed (for example, T Tank Farm and S-SX Tank Farms). To minimize the probability of future leaks, all of the single-shell tanks at the Hanford Site have been interim-stabilized, and the drainable liquid in each tank has been removed and transferred to double-shell tanks.

Plumes of chromium, nitrate, and technetium-99 in groundwater from Central Plateau tank farms represent a growing contamination issue which is being addressed by pump-and-treat systems.

3.1.5 Cleanup

Cleanup activities on the Central Plateau are being performed to protect human health, the environment, and the Columbia River. Waste sites within the Central Plateau are a lower priority for cleanup than waste sites within the River Corridor because of the proximity of the latter to the Columbia River (DOE/RL-2009-10, *Hanford Site Cleanup Completion Framework*). Thus, more progress has been made remediating waste sites in the River Corridor than on the Central Plateau. Remediation of the Central Plateau waste sites is expected to accelerate once many of the River Corridor waste sites transition into long-term stewardship. Until then, cleanup activities on the Central Plateau are focused on completion of decision documents, remediation of groundwater plumes, removal of the PFP, other facility decontamination and decommissioning, and initiation of waste-site cleanup in the Outer Area.

Two interim-action pump-and-treat systems have been remediating groundwater in the 200 West Area since 1995, and a third system started operating in 2007. The systems in 200-ZP-1 focus on the carbon tetrachloride plume near its source at the PFP and the technetium-99 plume from the T Tank Farm, while the U-Plant system within 200-UP-1 was designed for the uranium and technetium-99 plumes from the 216-U-1/2 Cribs (Figure 3.1-8). The final ROD for the 200-ZP-1 Operable Unit was issued in 2008 (EPA et al., 2008, *Record of Decision Hanford 200 Area 200-ZP-1 Superfund Site Benton County, Washington*), and a final remedy pump-and-treat system for the carbon tetrachloride and other 200-ZP-1 plumes is being constructed. This system will consist of 20 extraction wells, 16 injection wells, and a treatment plant with a capacity of 9,500 liters per minute (see Figure 3.2-6 in Section 3.2 for the extraction and injection well locations). This new pump-and-treat system is planned to begin operating during 2012, at which time the 200-ZP-1 interim-action systems will be shut down. The 200-UP-1 system was shut down during 2011 because it had achieved its interim remedial action objectives and the flow rates from the extraction wells were too low to justify continued pumping. DOE released a draft RI/FS (DOE/RL-2009-122, *Remedial Investigation/Feasibility Study for the 200-UP-1 Groundwater Operable Unit*) and proposed plan (DOE/RL-2010-05, *Proposed Plan to Amend the 200-ZP-1 Groundwater Operable Unit Record of Decision to Include the Remedial Actions for the 200-UP-1 Groundwater Operable Unit*) for 200-UP-1 in 2010, and is preparing final documents that address further remediation of the 200-UP-1 plumes. Figure 3.1-8 shows 200 West Area contaminant plumes, locations of the pump-and-treat systems, and the amount of contaminant removed from the subsurface over time.

Soil vapor extraction is being used to remove carbon tetrachloride from the vadose zone beneath waste sites at the Plutonium Finishing Plant. Various systems have operated since 1992 with capacities ranging from 14.2 to 42.5 cubic meters per minute. Two systems are currently operating with a total combined capacity of 28.3 cubic meters per minute. Figure 3.1-8 shows where soil vapor extraction is being performed.

No active remediation is occurring within the 200 East Area groundwater operable units, but a treatability test to remediate a uranium-contaminated perched water zone beneath the B Complex began during 2011 as part of the deep vadose zone operable unit, 200-DV-1[3]. The draft RI for 200-PO-1 was released during 2010 (DOE/RL-2009-85, *Remedial Investigation Report for the 200-PO-1 Groundwater Operable Unit*) and the process to prepare the RI/FS for 200-BP-5 (DOE/RL-2009-127, *Remedial Investigation Report 200-BP-5 Groundwater Operable Unit*) has been initiated.

[3] The 200-DV-1 Operable Unit was created to address waste sites with deep vadose zone contamination posing a threat to groundwater quality and for which standard surface-based remedies cannot be used. It currently consists of waste sites in the vicinity of WMA B-BX-BY in the 200 East Area, and WMA T, WMA TX-TY, and WMA S-SX in the 200 West Area, although additional waste sites may be added in the future.

Figure 3.1-1. Hanford Site Central Plateau Regions

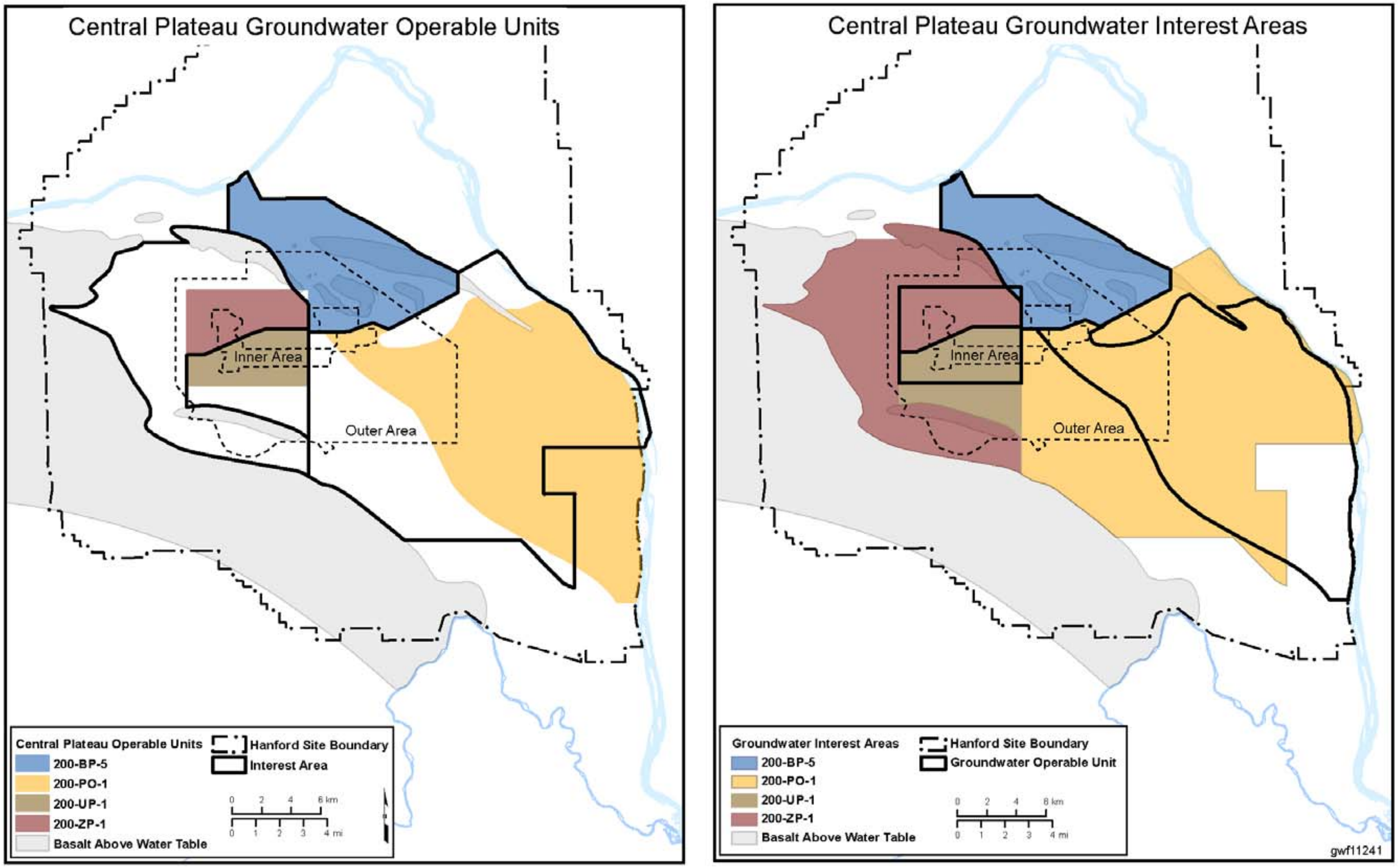
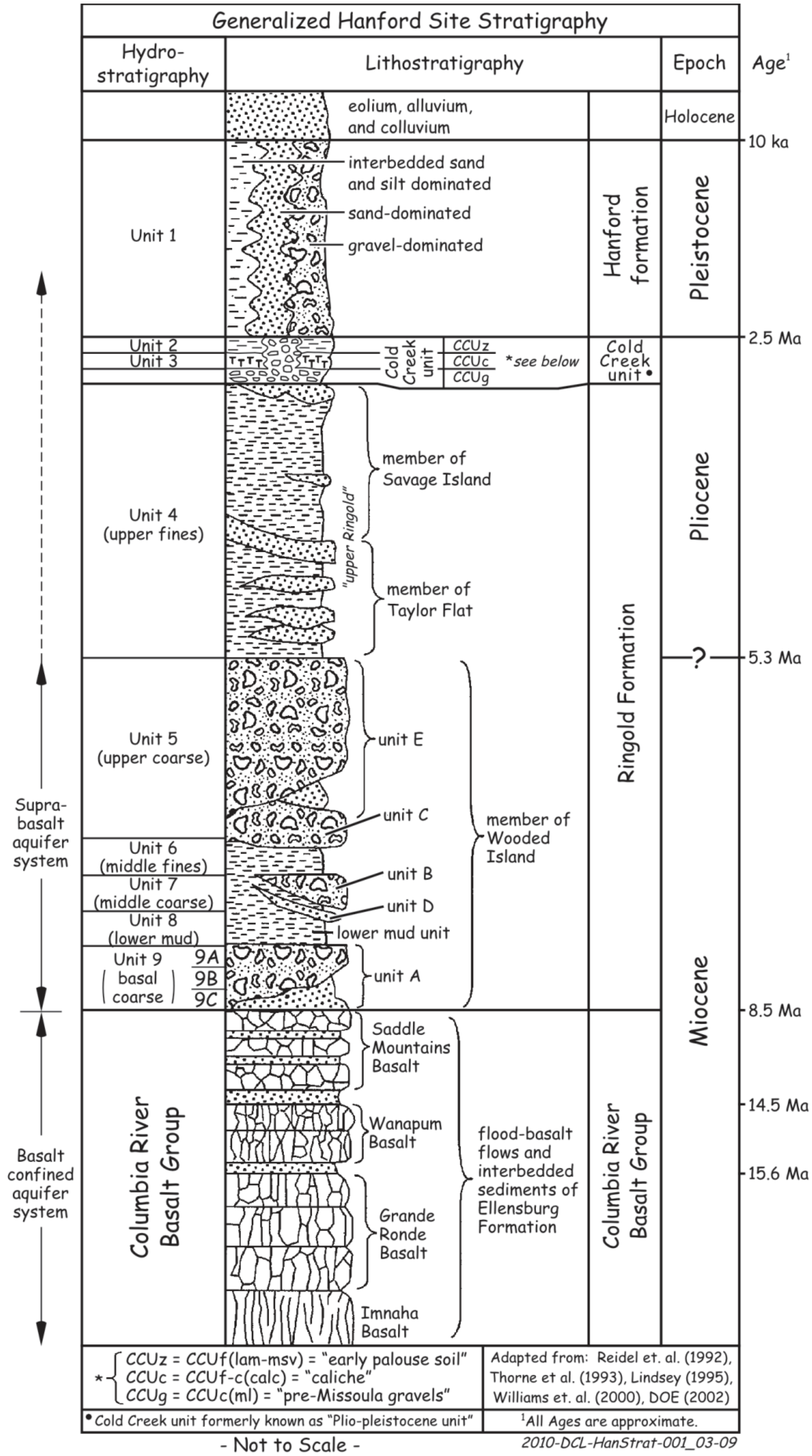


Figure 3.1-2. Stratigraphic Column for the Hanford Site



gwf11248

Figure 3.1-3. Hydrostratigraphic Cross-Section through the Hanford Site

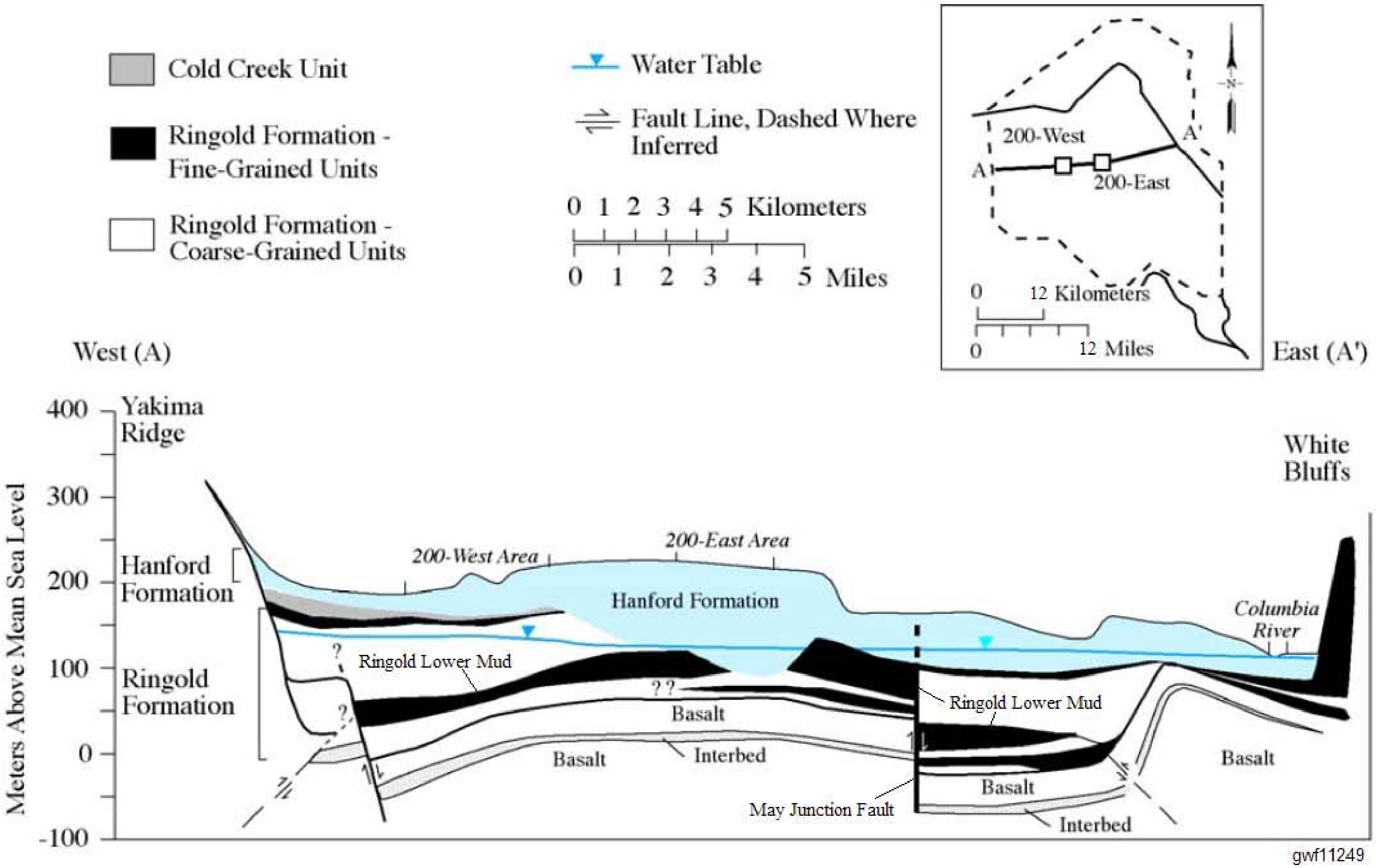


Figure 3.1-4. Hydraulic Conductivity Distribution at the Maximum Table Elevation

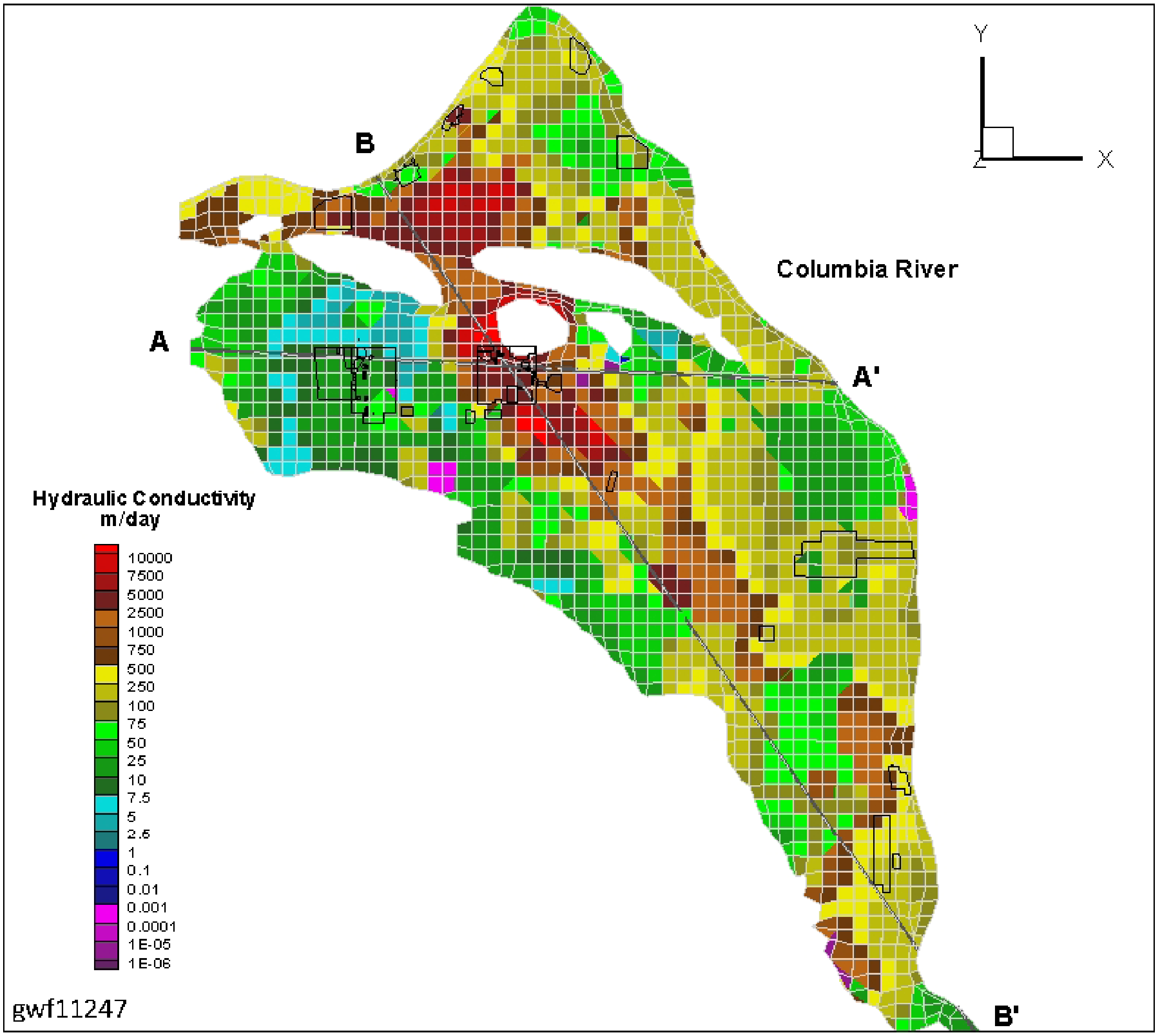


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Figure 3.1-5. Hanford Site Water Table, March 2011

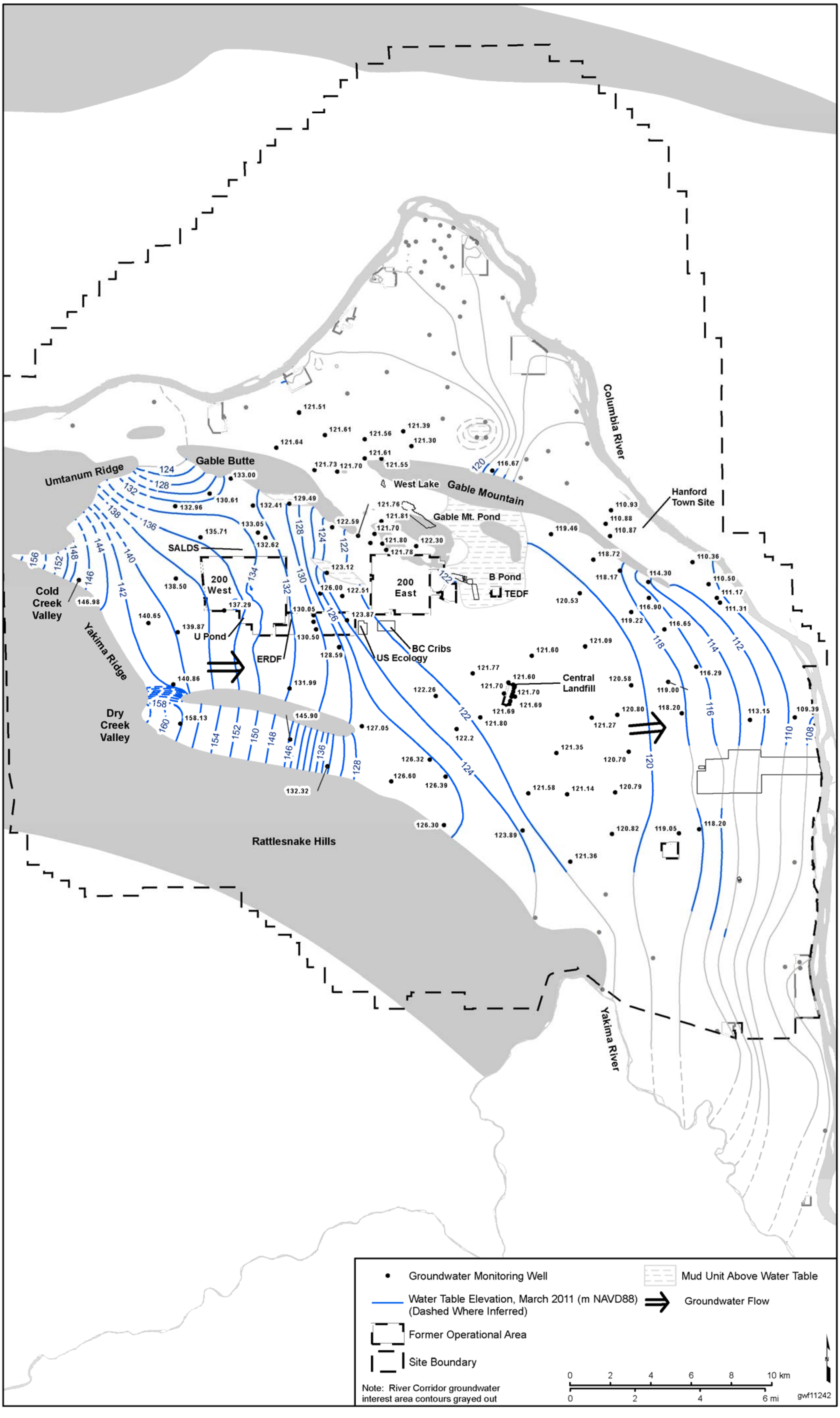

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Figure 3.1-6. Average Tritium Concentrations on the Hanford Site, Upper Part of Unconfined Aquifer, 2011

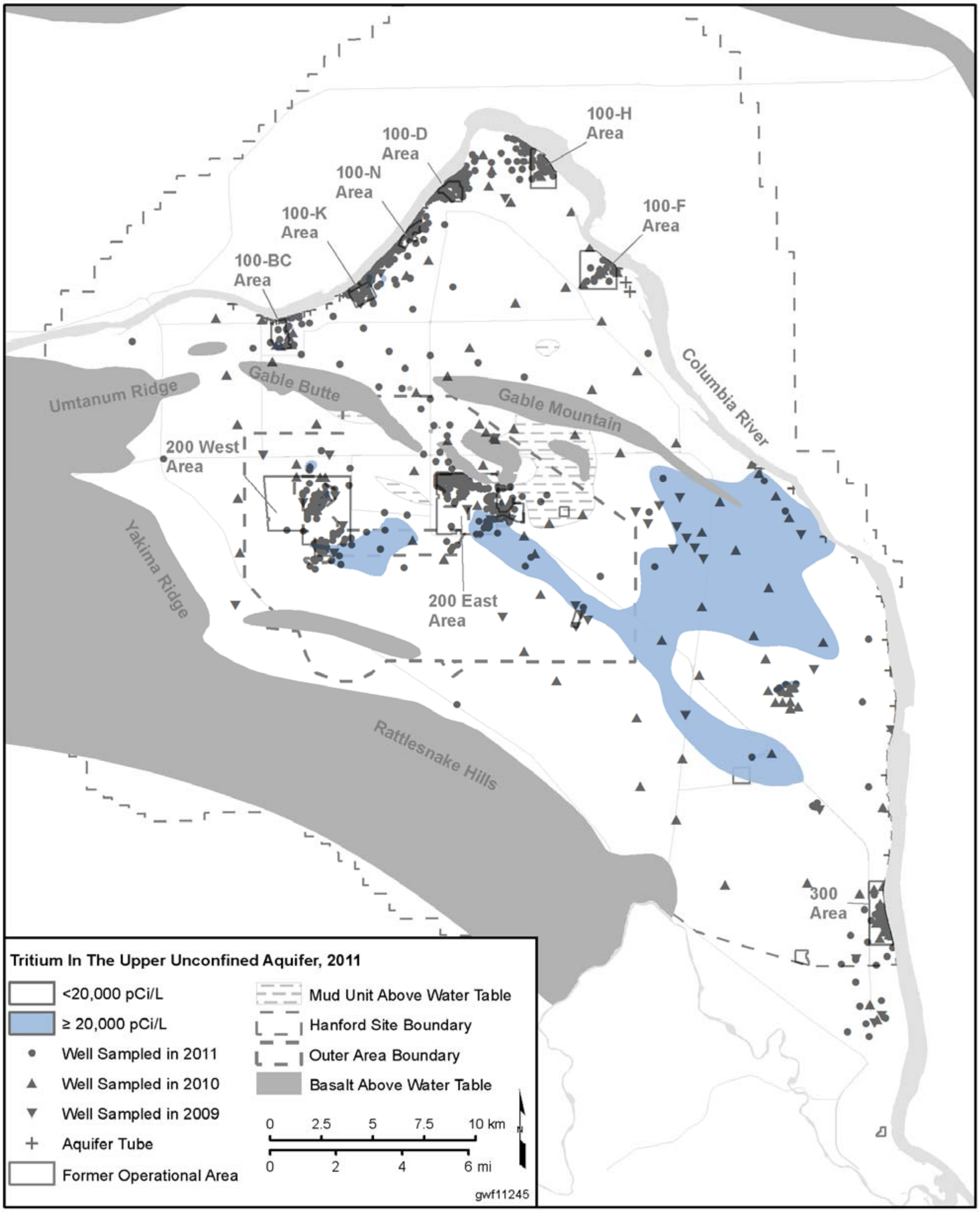


Figure 3.1-7. Average Iodine-129 Concentrations on the Hanford Site, Upper Part of Unconfined Aquifer, 2011

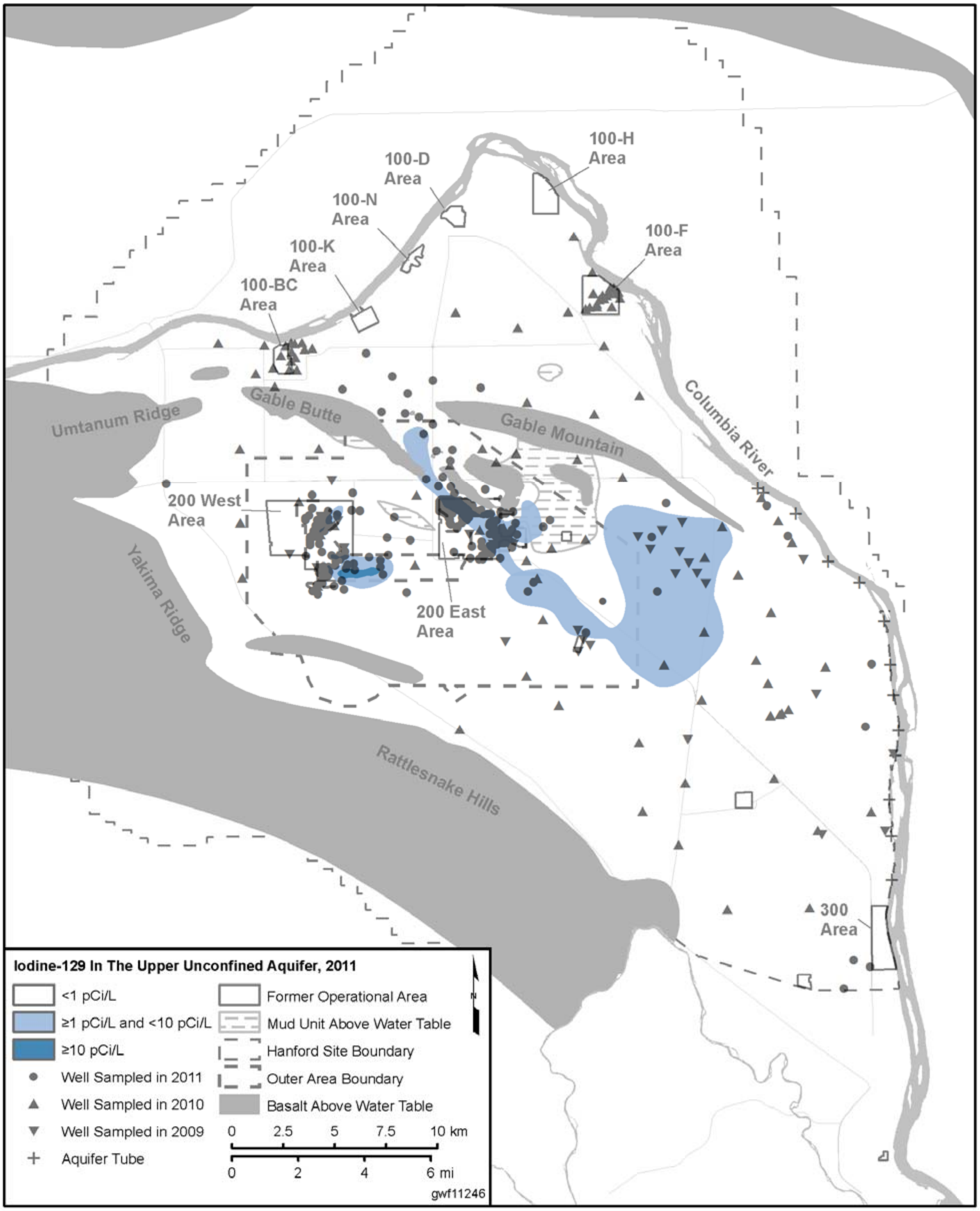
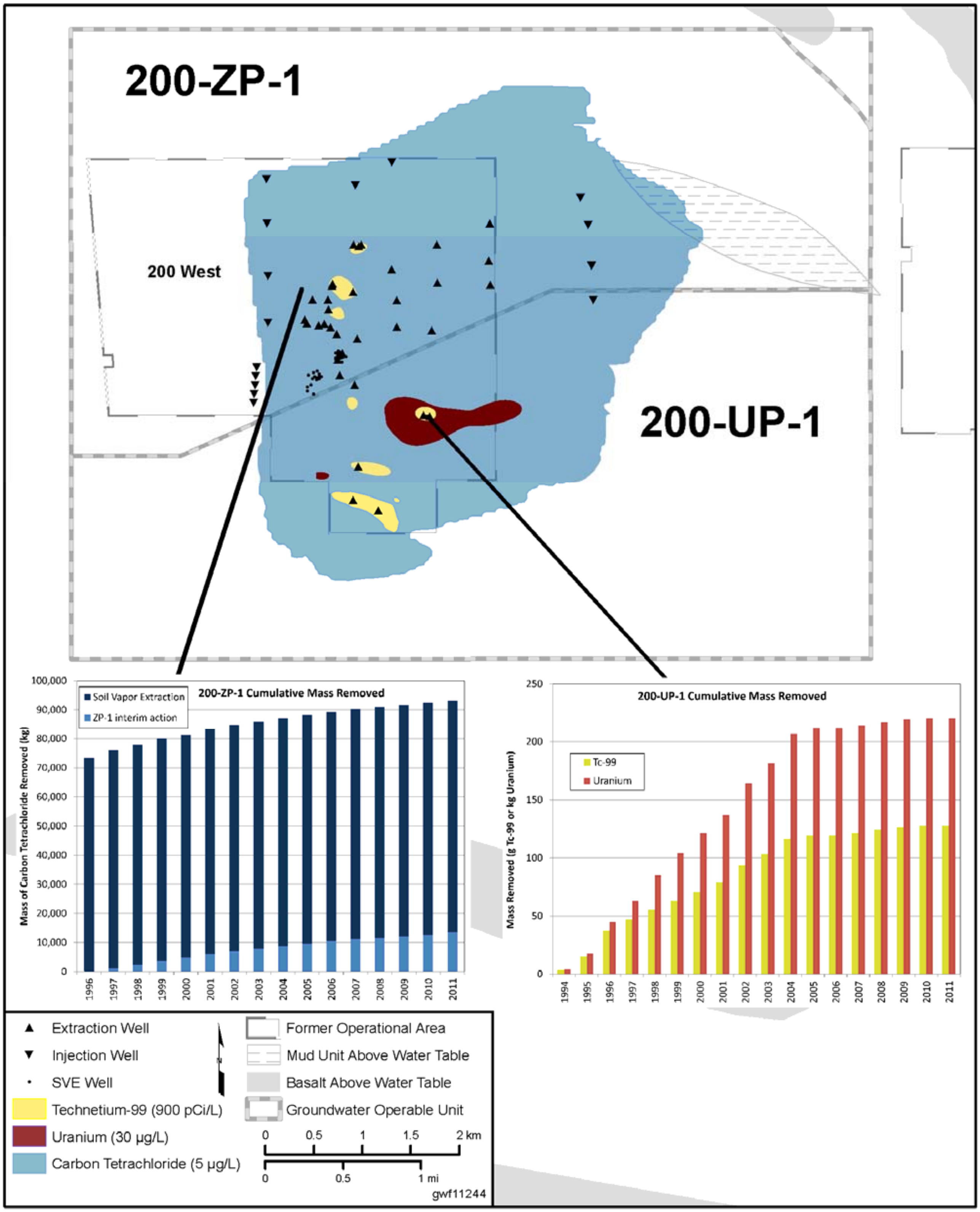


Figure 3.1-8. Remediation Systems in the 200 West Area



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